CLAIMS

What is claimed:

1. A method for controlling exposure dose in a lithographic system comprising:

adjusting said exposure dose as a function of resist sensitivity changes, further comprising;

a) calculating a batch factor by using historical data; and,

b) adjusting said exposure dose based on said calculated batch factor.

2. The method for controlling exposure dose in said lithographic system as claimed in Claim 1, wherein said historical data comprises batch factors and optimum exposure doses from at least one lot run previous to a current lot run.

3. The method for controlling exposure dose in a lithographic system as claimed in Claim 2, wherein a reference dose is calculated according to a computation comprising an equation:

$$Dose_{ref} = \frac{\sum_{k=-1}^{-n_{ref}} (Dose_k / BF_k)}{n_{ref}}$$

wherein:

$Dose_{ref}$ is a reference dose used to calculate a batch factor;

BF_k is at least one previously calculated batch factor from said at least one lot run prior to said current lot run;

$Dose_k$ is at least one previously calculated dose from said at least one lot run prior to said current lot run;

n_{ref} is a number of lots run in a history prior to an initial of said resist sensitivity changes.

4. The method for controlling exposure dose in said lithographic system as claimed in Claim 3, wherein said batch factor is calculated according to a computation comprising an equation:

$$\mathbf{BF_{m-1} = Dose_{m-1}/Dose_{ref}}$$

wherein:

BF_{m-1} is the batch factor for a most recent lot of product already run;

$Dose_{m-1}$ is an optimum dose for said most recent lot of product already run;

$Dose_{ref}$ is the reference dose used to calculate said batch factor.

5. The method for controlling exposure dose in a lithographic system as claimed in Claim 4, wherein said adjusting of said exposure dose includes a computation comprising an equation:

$$Dose_{new} = \frac{\sum_{k=m-n_{calc}}^{m-1} (Dose_k * \frac{BF_{m-1}}{BF_k})}{n_{calc}}$$

wherein:

$Dose_{new}$ is said calculated dose for a next lot based on said historical data;

$Dose_k$ is at least one previously calculated dose from lot runs prior to said next lot run;

BF_{m-1} is said batch factor for said most recent lot of product already run;

BF_k is at least one previously calculated batch factor from lot runs prior to said next lot run;

n_{calc} is a number of lots, including lots run after said initial of said resist sensitivity changes, used to calculate said new dose.

6. The method for controlling exposure dose in said lithographic system as claimed in Claim 5, wherein:

said resist sensitivity changes correspond to a step function from an old resist sensitivity to a new resist sensitivity; and,

all batch factors subsequent to said step function are assigned with a value of said batch factor for said most recent lot of product.

7. The method for controlling exposure dose in a lithographic system as claimed in Claim 4, wherein:

a) an old reference batch factor is calculated based on batch factors from all lots prior to said initial of said resist sensitivity changes;

b) a most recent lot mixing factor and a new lot mixing factor are calculated based on known mixing properties of said resist in said lithographic system;

c) at least one steady state batch factor for each lot, applicable after a new of said resist has entirely replaced an old of said resist, is calculated based on said most recent

lot mixing factor, said batch factor for said most recent lot of said product already run, and said old reference batch factor;

d) a new reference batch factor is calculated for a new product lot based on said at least one steady state batch factor;

e) a new batch factor is calculated for said new product lot based on said old reference batch factor, said new lot mixing factor, and said new reference batch factor;

f) said adjusting said exposure dose as a function of resist sensitivity changes, for said new product lot, is calculated based on said new batch factor and said historical data.

8. The method for controlling exposure dose in a lithographic system as claimed in Claim 5, wherein aging factors are applied to said batch factor for said most recent lot, and said exposure dose adjusting computation whereby said exposure dose adjusting computation compensates for said resist sensitivity changes that are caused by ambient temperature aging.

9. A system for controlling exposure dose in a lithographic exposure tool comprising:

means for adjusting said exposure dose as a function of resist sensitivity changes, further comprising;

a) means for calculating a batch factor by using historical data comprising batch factors and optimum exposure doses from at least one lot run previous to a current lot run;

b) said means for adjusting said exposure dose comprises calculating a value of said exposure dose based on said calculated batch factor whereby said exposure dose in said lithographic exposure tool is controlled.

10. The system for controlling exposure dose as claimed in Claim 9, wherein said means for adjusting said exposure dose further comprises using said optimum exposure doses from said historical data.

11. The system for controlling exposure dose as claimed in Claim 9, wherein:

said resist sensitivity changes correspond to a step function from an old resist sensitivity to a new resist sensitivity; and,

said means for calculating said batch factor further comprises calculating a batch factor of 1 for all lots run subsequent to said step function.

12. The system for controlling exposure dose as claimed in Claim 9, further comprising:

a.) means for obtaining said calculated batch factor for a lot run prior to an initial of said resist sensitivity changes;

b.) means for obtaining said calculated batch factor for a most recent lot run;

c.) means for calculating a previous lot run mixing factor for modeling said resist sensitivity changes of said previous lot due to flow characteristics of said resist;

d.) means for calculating a next lot run mixing factor for modeling said resist sensitivity changes of said next lot due to said flow characteristics of said resist;

e.) means for calculating said calculated batch factor for a new lot, wherein said calculating means uses the calculated batch factors of step a.) and step b.), and the mixing factors of step c.) and step d.);

f.) means for calculating said value of said exposure dose based on said historical data and said calculated batch factor for said new lot.

13. The system for controlling exposure dose as claimed in Claim 9, wherein:

a means for applying an aging factor to compensate for an ambient temperature of said resist is applied to said calculated batch factor to increase accuracy of said calculated batch factor;

said means for applying said aging factor to compensate for said ambient temperature of said resist is applied to said value of said exposure dose to increase accuracy of said calculating said exposure dose value.

14 A computer program product comprising:

a computer usable medium having computer readable program code embodied therein for controlling exposure dose in a lithographic exposure tool, the computer readable program code in said computer program product comprising:

a.) first computer readable program code for causing the computer to calculate a batch factor by using historical data comprising batch factors and optimum exposure doses from at least one lot run previous to a current lot run;

b.) second computer readable program code for causing the computer to adjust said exposure dose wherein said adjustment comprises calculating a value of said exposure

dose based on said calculated batch factor whereby said exposure dose in said lithographic exposure tool is controlled.

15. The computer program product for controlling exposure dose as claimed in Claim 14, wherein said second computer readable program code further comprises third computer readable program code for causing the computer to use said optimum exposure doses from said historical data.

16. The computer program product for controlling exposure dose as claimed in Claim 14, wherein said resist sensitivity changes correspond to a step function from an old resist sensitivity to a new resist sensitivity; and,

said first computer readable program code for causing the computer to calculate a batch factor further comprises fourth computer readable program code for causing the computer to calculate a batch factor of 1 for all lots run subsequent to said step function.

17. The computer program product for controlling exposure dose as claimed in Claim 14, further comprising fifth computer readable program code for causing the computer to:

a.) obtain said calculated batch factor for a lot run prior to an initial of said resist sensitivity changes;

b.) obtain said calculated batch factor for a most recent lot run;

c.) calculate a previous lot run mixing factor for modeling said resist sensitivity changes of said previous lot due to flow characteristics of said resist;

d.) calculate a next lot run mixing factor for modeling said resist sensitivity changes of said next lot due to said flow characteristics of said resist;

e.) calculate said calculated batch factor for a new lot, wherein said calculation uses the calculated batch factors of step a.) and step b.), and the mixing factors of step c.) and step d.);

f.) calculate said value of said exposure dose based on said historical data and said calculated batch factor for said new lot.

18. The computer program product for controlling exposure dose as claimed in Claim 14, further comprising sixth computer readable program code for causing the computer to:

apply an aging factor to compensate for an ambient temperature of said resist to said calculated batch factor wherein increased accuracy of said calculated batch factor is achieved;

apply said aging factor to compensate for said ambient temperature of said resist to said value of said exposure dose to increase accuracy of said exposure dose value.

19. A system for controlling a process parameter value comprising:

means for adjusting said process parameter value as a function of material property changes, further comprising;

a.) means for calculating a batch factor by using historical data comprising batch factors and an optimum of said process parameter value from at least one lot run previous to a current lot run;

b.) said means for adjusting said process parameter value comprises calculating said process parameter value based on said calculated batch factor whereby said process parameter value is controlled.